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Useful Information for Environmental Assessments

Canada

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Errata

Section 6, page 9, left-hand column, 3rd paragraph, second last line:

> baseline noise environments, or when the ~~baseline plus~~ project-related noise is in excess of 75 dB.

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This document outlines information that would be beneficial to include in environmental assessment documents when requesting Health Canada's advice as a federal authority under subsection 12(3) of the *Canadian Environmental Assessment Act* (the Act), and/or under provincial/territorial environmental assessment processes. For more information on the Act and Canada's federal environmental assessment process, please refer to the Canadian Environmental Assessment Agency.

Purpose of this document

The purpose of this document is to provide assistance to stakeholders involved in the environmental assessment process, and to facilitate the preparation and review of environmental assessments in a consistent and effective manner. The information contained herein is directed towards federal government departments that are responsible authorities, and is intended to assist them in guiding the proponent in the early stages of the environmental assessment process. Provincial and territorial agencies may also find this information useful when requesting Health Canada's advice on their environmental assessments.

In the context of subsection 12(3) of the Act, Health Canada currently has expertise in the following biophysical areas related to human health:

1. Air quality effects
2. Contamination of country foods (fish, wild game, garden produce, berries, etc.)
3. Drinking and recreational water quality
4. Radiological effects
5. Electric and magnetic fields effects
6. Noise effects
7. Human health risk assessment (HHRA) and risk management
8. Federal air, water and soil quality guidelines/standards used in HHRAs
9. Toxicology (multimedia – air, water, soil)
10. First Nations and Inuit health

In order to obtain Health Canada's advice, responsible authorities, panels, mediators and/or provincial/territorial authorities involved in environmental assessment should submit a written request for Health Canada's expertise regarding the potential effects of a proposed project on human health. If the responsible authority is uncertain which of the above-listed biophysical areas is applicable to a proposed project, Health Canada can provide advice on this, or a review of each area. To help expedite Health Canada's reviews of technical study/environmental assessment documents, it is useful for the written request to indicate which sections of the documentation are to be reviewed by Health Canada, and/or pose specific questions to be addressed by Health Canada.

Note that Health Canada's role under subsection 12(3) of the Act is advisory only. The responsible authority (or the provincial/territorial authority) determines how the advice provided by Health Canada will be used in the environmental assessment process, and the responsible authority (or the provincial/territorial authority) makes all decisions related to the environmental assessment of the project. In areas of jurisdictional overlap, it is the responsible authority's (or the provincial/territorial authority's) responsibility to determine whether Health Canada advice is applicable.

Health Canada advises that consideration be given to the potential effects on human health for all phases of a proposed project (i.e. construction, operation, modification, decommissioning and abandonment), and that baseline data, predicted project values, and cumulative effects be considered, as appropriate.

Health Canada suggests that all information relevant to human health be documented in one section of the environmental assessment, and that all relevant assumptions, reference values, models, equations and reference citations be clearly stated.

The following sections of this document, ordered by area of expertise, provide guidance on the key elements that would be beneficial to Health Canada in providing advice on the assessment of the potential effects of a proposed project on human health. It is important to note that not all items listed in each area of expertise are applicable to all types of proposed development projects. Health Canada may request additional information in order to provide advice on a project-specific basis.

Health Canada is also developing detailed guidance documents in the following areas of expertise: air quality effects, the contamination of country foods, drinking and recreational water quality, noise effects, and human health risk assessment.

1. Air Quality Effects

In an assessment of potential changes in air quality, it is advisable to consider local, regional, and where appropriate, long-range impacts on air quality during all phases of the project. It is advisable to also consider the following:

- An inventory of all potential contaminants and emissions from the proposed project: criteria air contaminants (i.e. sulphur oxides [SO_x], nitrogen oxides [NO_x], particulate matter [PM] including total PM, PM_{10}, and $PM_{2.5}$, volatile organic compounds [VOCs], carbon monoxide [CO], ammonia [NH_3], ground-level ozone [O_3], and secondary particulate matter [secondary PM]); air pollutants on the *List of Toxic Substances* in *Schedule 1* of the *Canadian Environmental Protection Act, 1999* (CEPA Registry, 1999); diesel PM; and other possible contaminants.
- Information regarding the location of the project and the distance to all potential human receptors for different uses (residential, recreational, etc.) within the area affected by the project.
- A characterization of baseline levels of potential contaminants and emissions undergoing further assessment (i.e. before the project scenario), and a rationale for any project emissions not considered in the assessment.
- Assessments of the following scenarios: baseline alone (i.e. before the project scenario); project alone; project plus baseline; and cumulative (i.e. project plus baseline plus all other approved or reasonably foreseeable projects).
- A comparison of predicted project-related changes in ambient air quality to applicable air quality benchmarks relevant to human health (Canada-wide Standards, National Ambient Air Quality Objectives, provincial regulations, etc.), and a discussion of the potential effects on human health. Note that air quality criteria and standards should not be considered as "thresholds" below which health effects do not occur.
- Where modelling has been used, a description of the model and all assumptions that may affect the outputs.
- In cases where modelling results for the current project or measurements from similar projects predict exceedances or near exceedances of applicable air quality standards or guidelines, a discussion of the potential impacts on human health and a further level of assessment (e.g. a human health risk assessment), if appropriate.
- Information on mitigation measures that will be taken to minimize any negative impacts to air quality during all phases of the project. Examples of mitigation measures include: the use of properly maintained engines, the reduction of idling time, dust minimization practices, and the inclusion of pollution control devices (e.g. Cheminfo Services 2005).
- A description of air monitoring plans and/or follow-up programs, if applicable.

Health Canada currently does not possess the expertise to provide advice on odour and health effects.

Please note that Health Canada does not verify air quality modelling results and assumes that correct and accepted and/or validated methods were used. Health Canada relies on the expertise of Environment Canada for the review of air quality modelling results and the provision of related advice. If errors and/or gaps in the modelling are noted by Environment Canada, it is suggested that revisions be made to address them as indicated by Environment Canada. If the revised results differ from the originally submitted results, it is advised that the report be resubmitted to Health Canada for review.

2. Contamination of Country Foods

Country foods, also known as traditional foods, include those foods trapped, fished, hunted, harvested or grown for subsistence or medicinal purposes, or obtained from recreational activities such as sport fishing and/or game hunting. Country foods do not include foods produced in commercial operations (large farms, greenhouses, etc.).

It is advisable to consider the following in an assessment of the potential for contamination of country foods:

- A discussion of whether country foods are consumed, or are expected to be consumed, in the potentially affected area (considering First Nations and Inuit people, local residents, hunters, fishers and trappers). Whenever possible, identify what country foods are consumed, which parts of the country foods are consumed if applicable (e.g. whether organs are consumed as well as the meat), and their consumption frequency using surveys of potentially affected people.
- An inventory of all potential contaminants (including naturally-occurring contaminants such as methylmercury) and a determination of whether possible transport pathways of these contaminants into country foods will result from project activities. A contaminant with a pathway relevant to food sources is considered a contaminant of potential concern (COPC).
- A further level of assessment (e.g. HHRA) if there is potential for contamination of country foods as a result of the project activities. An HHRA would consider adequate baseline data and/or modelling of COPCs in country foods prior to any project activities, a predicted impact of project activities on the concentration of contaminants in country foods, a risk characterization of the possible impacts from project activities, and possible risk management strategies, if appropriate.
- A further level of assessment is not necessary if any of the following criteria are met:
  - no COPCs are identified;
  - no feasible, operable transport pathways into country foods exist;
  - no country foods are harvested from the areas; or
  - no human receptors are identified during the project lifespan (i.e. the current project and future projects), or after the project lifespan if there are any residual contaminants.
- A detailed justification, if it is decided that an assessment of the potential for contamination of country foods is not needed, or if certain COPCs are being excluded.
- Information on the mitigation measures that will be taken to minimize any negative impacts on country food quality during all phases of the project. These measures may include the reduction of emissions (e.g. closed-loop processes or emissions scrubbers for industrial projects), the use of consumption advisories when increases of contaminant levels are unavoidable, and educational programs to reduce the affected population's intake of contaminated country foods.
- A description of monitoring plans and/or follow-up programs, if applicable.

3. Drinking and Recreational Water Quality

It is advisable to consider the following in an assessment of the potential impacts on drinking and recreational water quality:

- The identification of all sources (surface and groundwater) of drinking water, as well as water used for recreational purposes, within the area of influence of the project. Drinking water sources include water intakes for drinking water treatment facilities and/or sources that are consumed directly (i.e. residential wells and

on-site wells for workers). Recreational use of natural waters includes any activity with the potential for intentional or accidental immersion in natural waters (wading, swimming, waterskiing, surfing, rowing, canoe touring, fishing, sailing, etc.).

- The identification of potential human receptors, considering those who may be exposed to contaminants via drinking water sources, and/or recreational waters.
- An examination of the potential impacts on the quality of drinking water sources during all phases of the project, as well as the potential for cumulative effects on the quality of these water sources. It is advisable to also consider impacts on physical parameters that can affect drinking water treatment processes. If any changes to water quality are predicted, Health Canada suggests that the potential effects on drinking water quality and human health be discussed.
- An indication of baseline levels of naturally-occurring contaminants (e.g. arsenic) in order to assess impacts on drinking water. The level of naturally-occurring contaminants may already be elevated, and may be further influenced by project activities.
- If a potential impact on a drinking water source is identified, a description of the measures to be employed to inform all potentially affected treatment facilities and/or well owners, and to mitigate risk to human health (measures to eliminate/reduce predicted changes, treatment, use of alternative sources, etc.).
- An examination of the potential impacts on recreational waters during all phases of the project. If any changes to recreational waters are predicted, Health Canada suggests that the potential effects on human health be discussed. If potential impacts on recreational waters are identified, describe the measures to be employed to inform users, and to mitigate any risk to human health (measures to eliminate/reduce predicted changes, restrict access, post signs, educate, etc.).
- Plans for monitoring drinking and recreational water quality, if applicable.

4. Radiological Effects

It is advisable to consider the following in an assessment of potential radiological effects:

- Provide quantitative information on baseline and predicted radiological parameters in air, water, soil, dust and foods, and discuss the implications of these parameters.
- Discuss the potential impacts of predicted radiation doses on both nuclear energy workers and the public during all phases of the project.
- Make every effort to keep exposure to radiation As Low As Reasonably Achievable (conforming to the ALARA principle) rather than simply meeting the requirements of the radiation protection regulations of the *Nuclear Safety and Control Act* (Canadian Nuclear Safety Commission 2004).

5. Electric and Magnetic Fields (EMF) Effects

It is advisable to consider the following in an assessment of potential EMF effects:

- The identification of all potential sources of EMF and potential human receptors in the project area.
- A discussion on the current state of scientific knowledge with respect to possible health effects from EMF exposure and a review of current exposure guidelines and/or position statements from health-related organizations (e.g. World Health Organization 2007).
- Background EMF levels at selected locations along the proposed site prior to construction, and their corresponding estimated levels after construction.

- A description of the mitigation measures that will be taken to reduce public exposure to EMF and to mitigate potential public concerns over the possible human health effects of project-related EMF.

6. Noise Effects

Health Canada does not have noise guidelines or enforceable noise thresholds or standards. Responsible authorities (and/or provincial/territorial authorities) are encouraged to consult with provincial and municipal authorities to determine which standards or regulations exist for the location of the proposed project, as differences may exist in their respective approaches to limiting noise impacts.

Health Canada's approach to noise assessment is to consider a variety of internationally recognized standards for acoustics (i.e. United States Environmental Protection Agency (U.S. EPA 1974), CAN/CSA ISO standards). Health Canada considers the following noise-induced endpoints as health effects: noise-induced hearing loss, sleep disturbance, interference with speech comprehension, complaints, and change in percent highly annoyed (%HA). The approach advised by Health Canada to noise assessment is based on the best possible characterization of baseline and project-related noise and its impact on potential noise-sensitive receptors. To obtain the highest quality data, Health Canada advises that acoustical assessments be completed by professional and properly trained consultants using methods that are recognized as the industry standard.

It is advisable that an assessment of noise exposure on human receptors located near the project site considers the following:

- The identification of all potential noise-sensitive receptors and their locations relative to the project area, and the identification of areas in which receptors could be considered to have a reasonable expectation of "peace and quiet" (i.e. "quiet rural areas"). The identification of sensitive receptors may include residences, daycares, school, hospitals, places of worship, nursing homes, and First Nations and Inuit communities.
- A delineation of the distance of the project to potential receptors using maps that indicate noise levels at various distances from the project site and identify all affected receptors. If any potential receptors are excluded from the assessment, provide a justification.
- The identification/assessment of baseline sound levels (measured or estimated) for both daytime (Ld) and nighttime (Ln) at the receptor locations.
- The identification of all potential noise sources during construction, operation and decommissioning (e.g. blasting, traffic, heavy equipment or transformers), and the identification of any tonal (e.g. sirens), low-frequency (e.g. wind turbines), impulsive (e.g. quarry or mining explosions), and highly impulsive (e.g. hammering, pile driving or pavement breaking) types of noise.
- A description of the methods (i.e. measured or estimated) used to obtain the baseline and predicted noise levels, including detailed information on how the noise assessment was conducted.
- A comparison of baseline noise levels with predicted noise levels at sensitive receptor locations during construction, operation, and/or decommissioning (during daytime and nighttime, and after mitigation, if warranted).
- The expected duration of noise due to construction activities (and, if applicable, operation and/or decommissioning activities). Note that Health Canada uses the Alberta Energy and Utilities Board Noise Control Directive 038 (2007) for guidance on whether construction noise should be considered short-term with regard to the prediction of complaint levels.

- If construction noise lasts for less than two months at receptors, it may be considered temporary, and community consultation is advised.
- For construction noise at receptors with durations of less than one year (i.e. short-term), Health Canada advises that mitigation be proposed if the resulting levels are predicted to result in widespread complaints or a stronger community reaction, based on the U.S. EPA method (U.S. EPA 1974, Michaud et al. 2008).
- For construction noise at receptors with durations of more than one year (i.e. long-term), for operational noise, and where noise levels are in the range of 45–75 dB, Health Canada advises that health impact endpoints be evaluated on the change in the percentage of the population (at a specific receptor location) who become highly annoyed (%HA). Health Canada suggests that mitigation be proposed if the predicted change in %HA at a specific receptor is greater than 6.5% between project and baseline noise environments, or when the ~~baseline-plus-~~project-related noise is in excess of 75 dB.

- An evaluation of the severity of predicted changes in noise levels and how they may affect human health.
- When health effects due to noise are predicted, Health Canada advises the identification of mitigation measures to limit noise, which typically include community consultation programs. In some situations where a specific type of mitigation is not technically or economically feasible, community consultation has achieved success in limiting the number of noise-related complaints.
- Noise management and noise monitoring plans, including complaint resolution, if applicable.

7. Human Health Risk Assessment (HHRA) and Risk Management

For a project to pose a potential risk to human health, three criteria must be present: the potential for emissions or the release of contaminants of concern (COPC), potential human receptor(s), and existing pathway(s) for human exposure to COPCs.

It is advisable that an HHRA include the following:

- A description of the HHRA methodology used, preferably one based on standard HHRA practice. If an alternate HHRA methodology is used, clearly describe the rationale for its use.
- A description of the purpose, objectives, scope and rationale for the HHRA.
- A description of temporal and spatial boundaries.
- An inventory of all COPCs including their use, quantity, fate, potential for bioaccumulation and transport. Health Canada suggests that any COPCs screened out be accompanied by a rationale as to why they would not be considered a potential concern for human health.
- A description of all potential exposure pathways and potential human receptors (including sensitive receptors) included in a conceptual model. It is advised that exposure pathways and human receptors screened out be accompanied by a rationale as to why they would not be a potential concern.
- A rationale for all assumptions, default values used and related uncertainties at all stages of the HHRA, and applicable references.
- A description of the exposure estimation, equations and calculations, supported by a worked example for one carcinogen and one non-carcinogen, and appropriate to the project conditions, to facilitate validation of the results of the HHRA.

- A description of the potential acute and chronic effects of COPCs (e.g. respiratory, organ, reproductive, teratogenic, mutagenic and carcinogenic) and mode of action (i.e. threshold and non-threshold) of COPCs.
- A rationale for the selection of toxicological reference values for COPCs.
- A comparison of the exposure estimate to a toxicological reference value and a determination of the potential risk to human health.
- A description of the reference risk levels used to assess human health risks and their source (e.g. incremental lifetime cancer risk < 1 in 100,000, hazard quotient < 0.2 or < 1.0).
- In cases where two or more COPCs may act in an additive manner upon receptors, consideration of the possible combined effects when characterizing health risks.
- A description of mitigation and risk management options in cases where potential exposure exceeds toxicological reference values.
- A discussion of uncertainties in the exposure and risk estimates. Health Canada suggests addressing issues such as: the quality and quantity of data; the use of maximum COPC concentrations; and factors, assumptions, and models that may lead to an overestimation or underestimation of exposures and risks.

8. Federal Air, Water, and Soil Quality Guidelines/ Standards Used in HHRAs

When an environmental assessment includes a comparison of air, water, food, and soil quality guidelines/standards to COPC concentrations, it is advisable to include the following information:

- A summary table clearly outlining the comparison of guidelines/standards to baseline or predicted data and highlighting any exceedances of guidelines/standards.
- A rationale for the selection of guidelines/ standards and the document reference.
- A discussion of how the guidelines and standards are relevant to human health (i.e. health-based) considering the type of COPCs, project receptors, spatial and temporal boundaries, land use conditions, etc.

9. Toxicology (multimedia— air, water, soil)

It is advisable that any discussion on the toxicology of COPCs (see section 7 on HHRAs) includes the following information:

- A summary of the COPCs' potential acute and chronic effects (e.g. respiratory, organ, reproductive, teratogenic, mutagenic or carcinogenic) and mode of action (i.e. threshold vs. non-threshold).
- A rationale for the selection of toxicological reference values for the COPCs used in the HHRA.

10. First Nations and Inuit Health

It is advisable that an assessment of First Nations and/or Inuit health consider the following:

- The location of First Nations and Inuit people in relation to the project.
- The size of the population(s) potentially affected.
- The presence of drinking water intakes and recreational water use (see section 3).
- Country food harvesting, the consumption of country foods and intake rates (see section 2).
- The incorporation of traditional and local knowledge for exposure assumptions (i.e. the location of traditional resource use).

Additional Information

Workers' Health

Only in certain limited situations does Health Canada have the expertise to comment on occupational health and safety aspects of projects. Health Canada has expertise related to nuclear workers as covered by the *Nuclear Safety and Control Act*.

It is advisable to consider the following in an assessment of the potential radiological effects of the project on nuclear workers:

- The identification of the radiation doses to the workers associated with the various duties in the project during applicable project stages (construction, operation, refurbishment/modification and decommissioning).
- The identification of the type of radiation and the duration of exposure, taking into consideration the different time frames specified in the *Radiation Protection Regulations* of the *Nuclear Safety and Control Act*.

For certain projects, workers may be housed onsite or nearby in workers' camps, and may be considered temporary residents. Depending upon the nature of the project, the responsible authority (and/or the provincial/territorial authority) may want to consider an assessment of potential effects on human health to off-duty workers residing onsite or in nearby workers camps.

Socio-economic Effects

Health Canada does not currently have the expertise to comment on the human-health-related socio-economic impacts of projects. Health Canada suggests that the responsible authority (and/or the provincial/territorial authorities) seek this expertise from appropriate agencies.

For More Information

The information presented in this document is current as of the publishing date. It is anticipated that revisions to this document will be necessary on occasion to reflect new information (resulting from research, standards, guidelines, or the development of new technologies). The most recent version may be obtained from Health Canada.

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Health Canada. Environmental Health Assessment – Publications. www.hc-sc.gc.ca/ewh-semt/pubs/eval/index-eng.php

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Government of Canada. 1999. National Ambient Air Quality Objectives for Ground-Level Ozone – Summary – Science Assessment Document. A report by the Federal-Provincial Working Group on Air Quality Objectives and Guidelines. www.hc-sc.gc.ca/ewh-semt/pubs/air/naaqo-onqaa/ground_level_ozone_troposperique/summary-sommaire/index-eng.php

Government of Canada. 1998. National Ambient Air Quality Objectives for Particulate Matter – Executive Summary. A report by the CEPA/FPAC Working Group on Air Quality Objectives and Guidelines. www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/air/naaqo-onqaa/particulate_matter_matieres_particulaires/summary-sommaire/98ehd220.pdf

Government of Canada. 1994. National Ambient Air Quality Objectives for Carbon Monoxide – Executive Summary – Desirable, Acceptable and Tolerable Levels. Prepared by the CEPA/FPAC Working Group on Air Quality Objectives and Guidelines. www.hc-sc.gc.ca/ewh-semt/pubs/air/naaqo-onqaa/carbon-monoxyde-carbone/index-eng.php

Contamination of Country Foods:

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See also references in **Health Risk Assessment and Risk Management** (below).

Drinking and Recreational Water Quality:

Health Canada. 2008. Guidelines for Canadian Drinking Water Quality Summary Table. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/sum_guide-res_recom/summary-sommaire-eng.pdf

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www.nuclearsafety.gc.ca/pubs_catalogue/uploads/G129rev1_e.pdf

Nuclear Safety and Control Act, 1997, c. 9.
http://lois.justice.gc.ca/en/showdoc/cs/N-28.3///en?page=1

Electric and Magnetic Fields Effects:

A Canadian perspective may be obtained from the following references:

Health Canada. 2004. It's Your Health – Electric and Magnetic Fields at Extremely Low Frequencies.
www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/magnet-eng.php

Federal-Provincial-Territorial Radiation Protection Committee. 2008. Response Statement to Public Concerns Regarding Electric and Magnetic Fields (EMFs) from Electrical Power Transmission and Distribution Lines.
www.hc-sc.gc.ca/ewh-semt/radiation/fpt-radprotect/emf-cem-eng.php

Other references that may be useful when discussing EMF issues include exposure guidelines recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), exposure standards published by the Institute of Electrical and Electronics Engineers (IEEE) and recent publications by the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC):

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ICNIRP. 1998. Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz). *Health Physics Society*, Vol. 74 (4): 494-522.
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IEEE. 2002. Standard C95.6-2002. IEEE standard for safety levels with respect to human exposure to electromagnetic fields, 0-3 kHz.
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WHO. 2007. Extremely Low Frequency Fields: Environmental Health Criteria Monograph No. 238. Published under the joint sponsorship of the International Labour Organization, the ICNIRP and the WHO.
www.who.int/peh-emf/publications/elf_ehc/en/index.html

WHO. 2007. Fact sheet No. 322. Electromagnetic fields and public health: Exposure to extremely low frequency fields.
www.who.int/mediacentre/factsheets/fs322/en/index.html

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Alberta Energy and Utilities Board. 2007. Energy Resources Conservation Board – Directive 038: Noise Control. Revised edition.
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